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RESEARCH ARTICLE

Does the use of the internet enhance residents' well-being?—Evidence from China

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ABSTRACT

Using data from the 2018 Chinese General Social Survey (CGSS), this study empirically examined the impact of Chinese residents' Internet use on their subjective well-being. The results show that Internet use significantly increases residents' subjective well-being; the results of the marginal effect show that the increase in Internet use increases the probability of residents choosing "Relatively happy" and "Extremely happy"; further analysis shows that Internet use increases the probability of residents choosing "Relatively happy" and "Extremely happy" through the marginal effect. "Moreover, in the heterogeneity analysis, Internet use significantly increases the subjective happiness of middle-aged people aged 35–60, and increases the subjective happiness of low-education and low-income groups, while rural residents have higher subjective well-being from Internet use relative to urban residents. This study mitigates the estimation bias that may be caused by the sample self-selection problem through propensity score matching (PSM), and conducts a series of robustness tests on the empirical results. Therefore, the government should emphasize the role of Internet use in enhancing residents' happiness and promoting the happiness effect of Internet use by further improving Internet infrastructure and upgrading residents' Internet use skills.

Keywords: internet use; resident; well-being; happiness; China

1. Introduction

Since the 21st century, China's economy has been developing rapidly, and information technology represented by the Internet has developed rapidly, bringing great convenience to people's lives, providing more space and opportunities for development, and changing people's lifestyles in an all-round manner[1]. As shown in **Figure 1**, the 51st Statistical Report on Internet Development in China shows that the number of Internet users in China has reached 1.067 billion, and the Internet penetration rate has reached 75.6%.
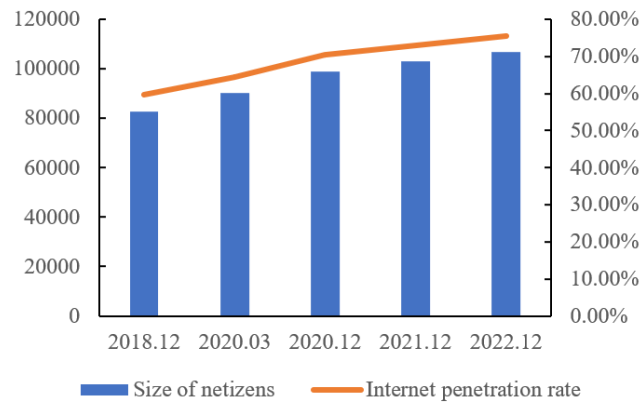
Figure 1. Scale of internet users and internet penetration rate in China, 2018–2022.
Data source: China Internet Development Statistical Survey.

The impact of the internet on people's way of life is multidimensional and extensive. The widespread application of the Internet in various social fields has made people's lives more convenient and diverse in terms of cultural and entertainment experiences. It has broadened the channels for accessing information, enriched the ways of acquiring knowledge, and made communication and shopping more convenient and autonomous[2]. Internet use can increase the frequency of people's social interactions, keep them abreast of current events in society, and enhance their confidence and ability to participate in social interactions. At the same time, active participation in social interaction also helps accumulate a large amount of social capital, which makes it easier to gain social understanding and acceptance and enhance their sense of social integration[3]; however, while the Internet brings material and spiritual enjoyment to people, it also facilitates the rapid spread of negative emotions in society[4], becoming an indicator that influences the overall social mentality[5]. For example, Internet-related scams and cyberbullying can lead to depression and anxiety among residents[6].

Happiness is an important value in people's lives, and can be considered an indicator of social progress. Subjective well-being refers to an individual's overall evaluation of their quality of life, including the emotional dimension of positive and negative affect balance, and the cognitive dimension of life satisfaction[7,8]. Happiness is people's ultimate pursuit of a better life, and exploring the path to improve residents' happiness is an important research topic[9]. Since Easterlin[10] pioneered the introduction of happiness into economic research in 1974, the literature on the factors influencing happiness has become increasingly rich. Scholars have primarily conducted research on the factors influencing happiness from both macro and micro perspectives. At the macro level, previous studies have found that economic factors, such as economic crises, inflation, and unemployment rates influence people's happiness[11]. Moreover, factors such as climate change and the environment[12], religious beliefs[13], and social institutions[14] also affect residents' happiness. At the micro level, researchers have mainly focused on studying the influence of happiness factors from individual characteristics, such as age differences[15], gender differences[16], employment status[17], and health conditions[18]. Furthermore, favorable social relationships, occupational participation, social and cultural orientations, and engagement enhance residents' happiness[19]. In terms of consumption, increasing residents' electricity consumption can increase their happiness[20]. However, these studies have focused more on developed countries, and few have focused on the impact of Internet use on well-being in developing countries. Currently, scholars are more likely to study the impact of specific Internet use on well-being, such as problematic Internet use (PIU)[21]. The question of whether the use of the Internet in residents' lives leads to changes in individuals' subjective well-being is still debated in existing research. This study discusses the impact of Internet use on the overall well-being (including quality of life and psychological state) of Chinese residents compared with non-use of the Internet.

With the development of the Internet, an increasing number of scholars have begun to focus on its impact of Internet use on happiness. As a modern way of life, the Internet expands social interactions, enriches individual experiences, and enhances the efficiency of information dissemination[22]. Compared with traditional lifestyles, the Internet, with its advantages of efficiency, convenience, and speed, enhances pleasant communication and satisfactory life experiences among individuals[23]. Internet-based online virtual interactions are an extension and expansion of offline real-life interactions, serving as an important component of interpersonal interactions, enhancing people's connections with the outside world, enriching lifestyles, and enhancing life experiences[24]. Communication networks formed through the Internet help individuals effectively cope with various pressures, alleviate depressive moods, and solve specific problems, thereby enhancing their happiness[25]. However, some scholars hold the opposite view, suggesting that internet use may lower individuals' subjective well-being[26]. The availability of comparative reference groups through Internet use expands, and the resulting social comparison behavior can affect people's psychological experiences and happiness[27]. For individuals with existing psychological problems, the advantages of the Internet are difficult to realize, and its negative effects become more prominent. The Internet isolates these individuals from healthy social activities, which not only fail to alleviate their existing problems, but also lead to new negative effects, directly damaging their happiness[28]. The impact of Internet use on traditional work and lifestyle patterns may also have potential negative effects on individuals' subjective well-being. For example, while the Internet improves work efficiency, it also increases the job insecurity of workers with low information technology skills[29]. Furthermore, the rapid development of Internet technology has led to an unprecedented speed in information dissemination on the Internet, and the spread of negative emotions is no exception. The accumulation of negative emotions contributes to a decrease in subjective happiness, which is a negative impact of the Internet on happiness[30].

Overall, there is currently no definitive consensus in the academic community regarding the impact of internet use on subjective well-being. Whether Internet use truly enhances people's happiness and whether these effects vary in different contexts and populations require further verification through more micro-level empirical research. As an emotional response, happiness essentially reflects people's overall evaluation of their work and life conditions[31]. Additionally, there is a lack of comprehensive discussion in the literature on how Internet use influences subjective well-being, with many theories based on specific perspectives lacking sufficient empirical testing. Therefore, studying the impact of internet use on the happiness of Chinese residents is of great practical and theoretical significance.

Based on data from the 2018 Chinese General Social Survey (CGSS), this study empirically examined the impact of Internet use on residents' well-being and attempted to further examine the mechanisms of action by which people's use of the Internet has an impact on their well-being. The marginal contributions of this study are as follows. First, based on the Chinese context, this study explores the Internet use of the residents of the world's largest developing country, enriching the Chinese evidence of the impact of Internet use on residents' well-being. Second, this study expands the research perspective at the individual micro level and incorporates social trust into the framework of the analysis of well-being, which not only contributes to a better understanding of the evolution of personal well-being in the Internet era, but also contributes to a better understanding of the impact of Internet use on residents' well-being. This study not only helps to better understand the evolution of personal happiness in the Internet era, but also helps to improve the related policies of Internet promotion and provides a new path for the mechanism of Internet use affecting residents' happiness. Finally, this study further analyzed the effects of Internet use on individual heterogeneity, such as age, region, education level, and income, and explored the differences in the characteristics of Internet use on the subjective well-being of different groups of residents.

The remainder of this paper is structured as follows: The second section introduces the data sample, variable construction, and model design, including descriptive statistics. The third section presents the empirical analysis, including regression analysis and robustness tests. The fourth section discusses the heterogeneity tests. The fifth section provides further analysis. Finally, the paper concludes with policy recommendations.

2. Data and model setting

2.1. Data source and sample selection

The data used in this study were derived from the questionnaire results of the "Chinese General Social Survey 2018" (CGSS2018) published by the China Survey and Data Center for China People's University. It employed a multistage stratified probability sampling design and was conducted through household interviews. The questionnaire covered 28 provinces, autonomous regions, and municipalities directly under the central government of Mainland China. The survey respondents were urban and rural residents aged 18 and above. The sample was highly representative and allowed reliable statistical inferences. In line with the research theme, this study processed the data by removing outliers and invalid samples, resulting in a final valid sample size of 12,149.

2.2. Research design and variable processing

This study focused on the impact of internet usage on residents' subjective well-being. Therefore, the dependent variable in this study was measured using the question "Overall, how happy do you feel about your life?" based on the CGSS. The response options followed the principles of the Likert five-point scale, ranging from "Extremely unhappy" to "Extremely happy," which were assigned values of 1, 2, 3, 4, and 5, respectively. Using subjective well-being to represent residents' welfare helps overcome the limitations associated with using income as a measure of welfare. Happiness is a subjective concept that is difficult to objectify; therefore, using a questionnaire is a reasonable and feasible approach[32].

The explanatory variable in this study is "Internet use," which is derived from the question "Have you used the internet in the past six months?" in the CGSS questionnaire. If the respondent has used the Internet, it is assigned a value of one; otherwise, it is assigned a value of zero.

The control variables are divided into two levels: individual and family characteristics. The individual characteristics level included Age, Gender, Education degree, Marriage, and Health, and we defined the value of education as years of education, setting unschooled =0, elementary =6, Junior High =9, High School =12, college =15, bachelor's degree =16, master's Degree or Ph.D. =19, Extremely Unhealthy =1, relatively unhealthy =2, acceptable =3, relatively healthy =4, and extremely healthy =5.

Family characteristics included social status, Homeownership, and Family size. The specific values for each variable are listed in **Table 1**.

Table 1. Variable definition.

Variables		Variable assignment description
Explained variable	$Happiness_i$	Extremely unhappy =1, Relatively unhappy =2, Acceptable =3, Relatively happy =4, Extremely happy =5
Explanatory variable	Internet use (IU_i)	Not using the internet =0; Internet use =1;
Individual characteristic variables	Age	The specific figures filled in by the respondents in the questionnaire shall prevail
	Gender	Female =0, Male =1

Table 1. (*Continued*).

Variables		Variable assignment description
	Education degree	Unschooled =0, Elementary school =6, Middle school =9, High school =12, Junior college =15, Undergraduate =16, Master or doctoral =19
	Marriage	Unmarried =0, Married =1
	Health	Extremely unhealthy =1, Relatively unhealthy =2, Acceptable =3, Relatively healthy =4, Extremely healthy =5
Family characteristic variables	Family social status	Far below average level =1, Below average level =2, Average level =3, Above average level =4, Well above average level =5
	Homeownership	Otherwise =0, Housing owner =1
	Family size	The specific figures filled in by the respondents in the questionnaire shall prevail.

Given that the explained variable $Happiness_i$ is ordered data, Ordinary Least Squares (OLS) estimation results in biased and inconsistent estimates. Therefore, we employ the Ordered Probit (Oprobit) model for the estimation. The empirical model specification for this study is as follows:

$$Happiness_i = \alpha_1 IU_i + \alpha_2 X_i + \varepsilon_i \tag{1}$$

By estimating the Oprobit model, we can analyze the impact of Internet use on residents' subjective well-being while controlling for various individual and family characteristics.

In Equation (1), $Happiness_i$ represents the subjective well-being of individual i and serves as the dependent variable. IU_i is the explanatory variable, representing Internet use. X_i refers to a series of control variables, including individual and family characteristics. ε_i is a random disturbance term.

2.3. Variable descriptive statistics

A descriptive analysis of the relevant variables was conducted to provide an initial understanding of the research sample, as shown in **Table 2**. The average subjective well-being score of the residents was 3.898, indicating a relatively high level of subjective well-being among Chinese residents, with most feeling happy. Meanwhile, the average value of Internet use was 0.622, indicating that more than half of the residents used the Internet. The variable "Gender" has a value of 0.469, suggesting a roughly equal proportion of male and female respondents, making it fairly representative. The average education degree is 8.799, indicating that China has achieved basic universal education with nine years of compulsory education; however, there is still room for improvement. Moreover, the variable "Marriage" represents whether the respondents are married, and 75.7% of the sample respondents are married. Additionally, 90.9% of the respondents owned housing, indicating a high homeownership rate among Chinese residents and a basic realization of the policy goal of providing housing for every resident. The variable "Family size" is 2.798, indicating that the majority of Chinese households consist of three members.

Table 2. Variable descriptive statistics.

Variables	Mean	Std. Dev	Min	P25	P50	P75	Max
Happiness	3.898	0.815	1	4	4	4	5
Internet use	0.622	0.485	0	0	1	1	1
Age	51.734	16.701	18	39	52	65	90
Gender	0.469	0.499	0	0	0	1	1
Education degree	8.799	4.921	0	6	9	12	19
Marriage	0.757	0.429	0	1	1	1	1
Health	3.545	1.075	1	3	4	4	5

Table 2. (*Continued*).

Variables	Mean	Std. Dev	Min	P25	P50	P75	Max
Family social status	4.225	1.672	1	3	5	5	10
Homeownership	0.909	0.288	0	1	1	1	1
Family size	2.798	1.393	1	2	2	4	9

3. Analysis of empirical results

3.1. Benchmark regression

Table 3 presents the regression results for the probit model. Column (1) includes only the explanatory variable and examines the direct impact of Internet use on the happiness of Chinese residents. The regression results showed a positive effect, indicating that Internet use significantly enhances the happiness of Chinese residents. Column (2) adds individual characteristic variables to the model and the explanatory variable remains statistically significant at the 1% level. Column (3) incorporates all the control variables into the model, and the regression results remain statistically significant at the 1% level. The results in Column (3) are consistent with those of the previous two models.

Regarding the control variables, according to the estimation results in Column (3) of **Table 3,** we observe a significant U-shaped relationship between age (and its squared term) and happiness. Furthermore, there is a gender difference in happiness, with males reporting lower levels of happiness than females. Additionally, we found a positive correlation between health, family size, and residents' happiness.

Overall, the direction and significance level of the explanatory variables remained consistent across the columns, indicating the robustness of the model estimation. These findings further support the idea that internet use significantly improves the happiness of Chinese residents.

Table 3. Benchmark regression.

Variables	Explained variable: Happiness		
	(1)	(2)	(3)
Internet use	0.118***	0.099***	0.078***
	(0.021)	(0.029)	(0.029)
age		−0.033***	−0.032***
		(0.004)	(0.004)
Square of age/1000		0.451***	0.426***
		(0.038)	(0.038)
Gender		−0.131***	−0.103***
		(0.021)	(0.021)
Education degree		0.019***	0.011***
		(0.003)	(0.003)
Marriage		0.267***	0.212***
		(0.027)	(0.028)
Health		0.258***	0.222***
		(0.012)	(0.012)
Family social status			0.156***
			(0.007)

Table 3. (*Continued*).

Variables	Explained variable: Happiness		
	(1)	**(2)**	**(3)**
Homeownership			0.139***
			(0.036)
Family size			0.028***
			(0.008)
/cut1	−2.185***	−1.507***	−0.971***
	(0.034)	(0.112)	(0.121)
/cut2	−1.379***	−0.639***	−0.068
	(0.022)	(0.110)	(0.118)
/cut3	−0.753***	0.029	0.629***
	(0.019)	(0.109)	(0.118)
/cut4	0.960***	1.825***	2.483***
	(0.019)	(0.111)	(0.120)
Observations	12,149	12,149	12,149

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3.2. Marginal utility

Owing to the unintuitive meaning of the parameters of the Ordered Probit model, the results in **Table 4** provide only limited information in terms of significance and parameter signs. Therefore, we used continuous marginal effects to calculate the marginal effect of the explanatory variable ($\widehat{IU}_i$) on $Happiness_i$ as shown in Equation (2). The meaning of the continuous marginal effect is how the probability of each value of the explained variable ($Happiness_i$) changes when the probability of the value of IU_i value changes

$$\frac{\partial Prob(Happiness = i \mid x)}{\partial Prob(IU = 1 \mid x)}\bigg|_{x=\overline{x}} = \frac{\partial Prob(Happiness = i \mid x)/\partial \widehat{IU}}{\partial Prob(IU = 1 \mid x)/\partial \widehat{IU}}\bigg|_{x=\overline{x}}, \quad (2)$$
$$(i = 1, 2, 3, 4, 5).$$

Table 4 presents the calculation results for marginal effects. When all variables are at the mean, the probability of internet use $Prob(IU = 1 \mid x)$ increases with each increase Δ, The probability of $Prob(Happiness = 1 \mid x)$ reducing the value of 'Extreme unhappiness' for happiness by 0.0020997Δ, $Prob(Happiness = 2 \mid x)$ reduces the probability of 'Relatively unhappiness' in the value of happiness by $0.0076857\ \Delta$, $Prob(Happiness = 3 \mid x)$ reduces the probability of "Acceptable" happiness by $0.00104703\ \Delta$, The probability of $Prob(Happiness = 4 \mid x)$ increasing the value of 'Relatively happy' for happiness by $0.008634\ \Delta$, The probability of $Prob(Happiness = 5 \mid x)$ increasing the value of 'Extreme happiness' by $0.0193923\ \Delta$. From the values shown in **Table 4**, it can be seen that for a resident with other conditions at an average level, their use of the internet increased the probability of residents choosing 'Relatively happy' and significantly increased the probability of giving 'Extreme happy'.

Table 4. Marginal utility.

Variables	Explanatory variable: Internet use				
Happiness	dy/dx	Standard error	Z statistics	*P* value	Significance
1	−0.0020997	0.0008000	−2.62	0.009	***
2	−0.0076857	0.0028819	−2.67	0.008	***

Table 4. (*Continued*).

Variables	Explanatory variable: Internet use				
3	−0.0104703	0.0039174	−2.67	0.008	***
4	0.0008634	0.0004574	1.89	0.059	*
5	0.0193923	0.0072513	2.67	0.007	***

3.3. PSM

Due to the potential differences in baseline characteristics between individuals who use the Internet and those who do not (such as age, marital status, and education level), there may be selection bias in the results of the baseline regression. To investigate the impact of Internet use on residents' happiness, this study employs propensity score matching (PSM) to mitigate the potential estimation bias caused by self-selection in the sample.

To ensure the robustness of the propensity score matching results, this study utilized two methods: nearest neighbor matching (NNM) and kernel matching. NNM matches the treated group (Internet users) with the control group samples that have the closest propensity scores. Kernel matching, on the other hand, matches the treated group with all control group samples using the average weighted estimate calculated based on propensity scores. First, a stepwise regression is conducted for the explanatory and control variables to identify the control variables that influence the explanatory variable. Propensity score matching was then performed to eliminate the influence of the control variables on the model.

Table 5 presents the results of propensity score matching. Column (1) represents one-to-one matching, column (2) represents one-to-two matching, column (3) represents one-to-three matching, column (4) represents one-to-four matching, column (5) represents one-to-five matching, and column (6) represents kernel matching. The regression results show that all six matching methods are statistically significant at the 1% level and the estimated results across the six matching methods are consistent. This indicates the robustness of the PSM results and suggests that internet use significantly promotes residents' happiness.

Table 5. PSM.

Variables	Explained variable: Happiness					
	One to one matching	One to two matching	One to three matching	One to four matching	One to five matching	Kernel Matching
	(1)	(2)	(3)	(4)	(5)	(6)
Internet use	0.284***	0.309***	0.280***	0.280***	0.270***	0.179***
	(0.081)	(0.084)	(0.082)	(0.079)	(0.074)	(0.058)
Individual characteristic variables	Yes	Yes	Yes	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3246	4430	5229	5811	6228	11,989

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3.4. Robustness check

To further examine the credibility of the regression results, we conducted robustness tests using three different approaches, as shown in **Table 6**. First, we change the dependent variable from "Happiness" to "Feeling depression," which is derived from the CGSS questionnaire item: "Have you felt depressed in the recent period?". The variable ranges from 1 to 5, and all the same control variables are introduced in an Ordered Probit regression model. The regression results remain statistically significant at the 1% level, as Column (1)

of **Table 6** shows.

Second, we replace the explanatory variable "Internet use" with "Internet use frequency" while keeping the regression steps consistent. The regression results remain statistically significant at the 1% level, as Column (2) of **Table 6** shows.

Third, we conduct robustness tests by replacing the regression model with an Ordered Logit model and Tobit model. The empirical steps are consistent with the baseline regression. The regression results presented in Column (3) of **Table 6** show that the explanatory variable remains statistically significant at the 5% level, which is consistent with previous findings. This suggests that the estimation results are robust.

In summary, robustness tests conducted using different dependent variables and alternative regression models confirm the reliability of the regression results.

Table 6. Robustness check.

Variables	Explained variable: Feeling depression	Explained variable: Happiness	
	Ordered probit	Ordered probit	Ordered logit
	(1)	(2)	(3)
Internet use	−0.177***		0.128**
	(0.028)		(0.052)
Internet use frequency		0.024***	
		(0.009)	
Individual characteristic variables	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes
Observations	12,149	12,149	12,149

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3.5. Placebo test

To test the validity of the research results, this study employed a placebo test by randomly generating an experimental group, aiming to verify the impact of Internet use on the happiness of Chinese residents. First, the core explanatory variable "Internet use" is randomized and then included in the model for regression analysis, producing an estimated coefficient $\hat{\beta}$. This process was repeated 1000 times, resulting in 1000 $\hat{\beta}$ estimates. **Figure 2** presents the distribution of $\hat{\beta}$, which closely resembles a standard normal distribution, with a mean close to zero. This indicates that the estimation equation passed the placebo test, demonstrating the robustness of the impact of Internet use on residents' happiness and ruling out interference from other random factors.
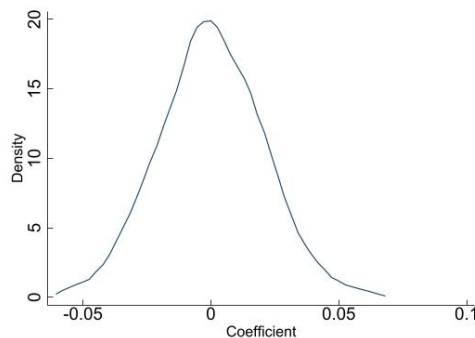

Figure 2. Placebo test.

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4. Heterogeneity analysis

4.1. By age

Individual behaviors during their lifecycles change with age[33], and there are significant differences in ideas and concepts among different age groups. Therefore, this study examined the impact of Internet use on residents' happiness from the perspective of different age cohorts. Building upon existing research, this study divides the sample into three sub-samples: 18–35 years old, 35–60 years old, and over 60 years old and conducts regressions separately. The regression results, as shown in **Table 7**, indicate that Internet use significantly enhances the happiness of residents aged 35–60, with a positive and statistically significant regression estimate at the 1% level. However, it was not significant for residents aged 18–35 and over 60 years. Generally, young people under 35 have early exposure to the Internet and have already enjoyed its benefits. However, middle-aged individuals are just beginning to explore the Internet and other new phenomena. Online shopping, videos, instant messaging, and other forms of Internet use greatly facilitate their lives and provide them with greater satisfaction. Additionally, owing to the relatively low number of elderly people using the Internet in China at present, the happiness effect of the Internet is not significant in this group[34].

Table 7. Heterogeneity analysis from the perspectives of age.

Variables	Explained variable: Happiness		
	18–35	35–60	More than 60
	(1)	(2)	(3)
Internet use	0.199	0.191***	−0.030
	(0.218)	(0.040)	(0.045)
Individual characteristic variables	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes
Observations	2440	5592	4117

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. By region and education degree

Constrained by the dual urban-rural structure and the imperfect structure and scale of government fiscal expenditure, there are significant urban-rural disparities in Internet development, and differences in Internet usage between urban and rural areas may exist. Therefore, we classify the sample according to urban and rural types. The regression results are shown in columns (1) and (2) of **Table 8**, where the explanatory variables are positively significant at the 10% and 1% levels, respectively. This indicates that Internet use can significantly enhance the happiness of residents in both urban and rural areas, with a greater impact on the happiness of rural residents than urban residents.

Furthermore, the results in **Table 8**, columns (3) and (4), show that Internet use significantly increases the happiness of individuals with low educational attainment, while it is not significant for individuals with higher educational attainment. We classified individuals with a junior college education or higher as having higher educational attainment, whereas others were classified as having lower educational attainment. Compared to individuals with lower educational attainment, those with higher educational attainment have higher income levels and enjoy a better quality of life, which may explain why internet use does not significantly improve their quality of life. For individuals with lower educational attainment, Internet use enriches entertainment activities, improves lives, and increases happiness.

Table 8. Heterogeneity analysis from the perspectives of region and education degree.

Variables	Explained variable: Happiness			
	City	Country	Lower education	Higher education
	(1)	(2)	(3)	(4)
Internet use	0.066*	0.136***	0.087***	0.079
	(0.037)	(0.051)	(0.030)	(0.168)
Individual characteristic variables	Yes	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes	Yes
Observations	8619	3530	9928	2221

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3. By income

To further understand the heterogeneity of the happiness effect of Internet use among different population groups, this study classified individuals based on their income levels to explore the impact of Internet use on the happiness of different income categories. The regression results are presented in **Table 9**. According to the CGSS questionnaire item "Which income level does your economic situation belong to?", we categorize "Far below average level" and "Below average level" as the low-income group, "Average level" as the middle-income group, and "Above average level" and "Well above average level" as the high-income group. The regression results indicate that Internet use significantly increases the happiness of the low-income group, whereas it is not significant for the middle- and high-income groups. This finding reflects the relevance and effectiveness of the current national "Internet poverty alleviation strategy".

Table 9. Heterogeneity analysis from the perspectives of income.

Variables	Explained variable: Happiness		
	Low-income	Middle-income	High-income
	(1)	(2)	(3)
Internet use	0.108***	0.0001	−0.122
	(0.042)	(0.043)	(0.136)
Individual characteristic variables	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes
Observations	5174	6197	822

Robust standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Further analysis

The study conducted by Sønderskov and Dinesen[35] indicated that social trust can facilitate the formation and achievement of group goals, promote social interaction, and ultimately enhance life satisfaction. Moreover, social trust can reduce the complexity of social interaction. Internet use allows people to engage in more frequent communication, and online interactions effectively bridge interpersonal gaps, thereby increasing residents' happiness[36]. In addition, with the prevalence of smartphones, individuals can share their daily lives with family and friends through apps such as Douyin (Chinese version of TikTok) and WeChat, which brings them closer and strengthens their sense of trust. It also enables timely assistance when others encounter difficulties, further enhancing social trust[37]. Therefore, it is evident that Internet use not only facilitates interactions and connections among individuals but also promotes online participation and the dissemination

of the "Internet + Cultural Happiness" model, fostering the cultivation and promotion of mainstream core values, and enhancing residents' sense of social trust, thereby increasing happiness[38].

Based on this, this study selected social trust as the mediating variable for examining the mechanism, following the approach proposed by Hayes[39]. The model is expressed as follows:

$$Happiness_i = a_0 + a_1 IU_i + a_2 \sum control_i + \varepsilon_i \tag{3}$$

$$M_i = a_0 + a_1 IU_i + a_2 \sum control_i + \varepsilon_i \tag{4}$$

$$Happiness_i = a_0 + a_1 IU_i + a_2 \sum control_i + a_3 M_i + \varepsilon_i \tag{5}$$

In the above model, M represents the mediating variable, social trust. This variable was derived from the question, "Do you think people are trusted in this society?". It is assigned a value of 1–5 to indicate "Extremely untrustworthy," "relatively untrustworthy," "average," "relatively trustworthy," and "Extremely trustworthy." The other variables remained consistent with the previous explanations.

According to the principles of the mediation effect model provided by Mehmetoglu[40], if the coefficients of the core variables in each equation are significant, this indicates the presence of a mediating effect.

Table 10 presents the regression results of the further analysis. The results in Column (2) demonstrate that social trust significantly enhances residents' happiness. The results in Column (3) indicate that Internet use and social trust are positively and significantly related at the 1% level of statistical significance. This suggests that internet use increases residents' subjective happiness through social trust. Therefore, a higher level of social trust increases the likelihood of internet use and enhances residents' subjective happiness.

Table 10. Further analysis.

Variables	Explained variable: Social trust	Explained variable: Happiness	
	(1)	(2)	(3)
Internet use	−0.150***		0.089***
	(0.028)		(0.029)
Social trust		0.079***	0.081***
		(0.010)	(0.010)
Individual characteristic variables	Yes	Yes	Yes
Family characteristic variables	Yes	Yes	Yes
Observations	12,149	12,149	12,149

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

6. Conclusion and policy implication

6.1. Conclusion

This study utilized data from the Chinese General Social Survey (CGSS) of 2018 to explore the impact of Internet use on residents' happiness. Our research results indicate that internet use significantly increases residents' subjective well-being; From the results of marginal effects, it can be seen that the increase in internet use increases the probability of residents choosing "Relatively happy" and "Extremely happy"; Moreover, in heterogeneity analysis, internet use significantly increased the happiness of middle-aged people aged 35-60, as well as the happiness of low education and low-income groups; Additionally, internet use significantly increases the happiness of urban and rural residents, with a greater impact on the happiness of rural residents compared to urban residents; Further analysis indicates that Internet use enhances residents' sense of happiness

through social trust. This study alleviated estimation bias caused by sample self-selection problems through propensity score matching (PSM) and conducted a series of robustness tests on empirical results, including a placebo test, all of which were robust. This study expands the research perspective at the micro level and incorporates social trust into the framework of happiness analysis. It not only helps to better understand the evolution of personal happiness in the Internet era but also helps to improve relevant policies for Internet promotion, providing a new path for the mechanism of the impact of Internet use on residents' happiness.

6.2. Policy recommendations

Based on the above analysis, we propose the following Policy recommendations:

Firstly, the government needs to strengthen the construction of internet infrastructure in rural areas, by promoting the reform of "increasing internet speed and reducing internet fees" in rural areas, lowering internet fees and access barriers, thereby increasing internet penetration and enabling rural residents, especially those with lower incomes, to use the internet more to improve their lives. The Internet is currently a fast track for rural economic development, and we should seize its advantages to attract more rural residents to become Internet users so that everyone can share the dividends of technological development. Nowadays, many rural areas in China have become prosperous through e-commerce, and this advantage needs to be promoted by the government. Second, Internet companies need to enrich and optimize the content of Internet platforms so that users can receive higher quality information. Give full play to the role of the Internet social networking platform and improve the frequency of interaction and communication among residents through Tiktok (Chinese version), WeChat, and other apps, so as to enhance the sense of social belonging of residents. Finally, young people in families should scientifically guide the elderly population to use the Internet, especially the Internet access function of smartphones, which not only creates opportunities for them to interact but also effectively teaches them to use their basic functions so that the Internet can better serve the elderly population. Furthermore, the government's Internet department should pay attention to and guide the emotional changes brought by Internet use to the user group, guide moderate use of the Internet in daily life, play the role of Internet use in promoting social interaction and trust among residents, improve residents' sense of happiness, and lay the foundation for the construction of common prosperity.

6.3. Limitations and future research

This study is based on the 2018 Chinese General Social Survey (CGSS) data, which may have time and sample limitations, and cannot reflect the long-term impact of Internet use on residents' happiness. Additionally, as this study used information filled out by respondents on the questionnaire, it may not be possible to comprehensively and accurately measure the frequency, mode, and content of Internet use. Based on this, we believe that future research can be conducted in the following aspects:

1) Deeply explore the long-term impact of Internet use on happiness: Future research can use longitudinal data to track individual changes in Internet use and happiness to better understand their long-term effects.
2) Future research can consider the content and methods of Internet use in more detail, such as social media usage and online shopping, to gain a more comprehensive understanding of the impact of Internet use on happiness.
3) Exploring the mediating mechanisms of Internet use: Future research can further explore the mediating mechanisms of the impact of Internet use on happiness, such as social support and self-expression, to better understand the pathways through which Internet use affects happiness.
4) Considering cultural differences, future research can compare the impact of Internet use on happiness across difft countries and cultural backgrounds to better understand the universality and specificity of Internet use.

Author contributions

Conceptualization, YW and JM; methodology, YW, QL and JM; software, XW; validation, YG, YW and QL; formal analysis, YW; investigation, YW and DS; resources, JM, QL, XW and YG; data curation, YW and XW; writing—original draft preparation, YW, QL and JM; writing—review and editing, YW, YG and DS; visualization, YW; supervision, YW and DS; project administration, YW, DS and JM; funding acquisition, YW. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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